

Abstract:

Manipulation and Control of Friction at the Atomic Scale

A wide variety of bioengineering processes involves motion of nano or molecular objects on periodic, rough or nanopatterned surfaces. Representative examples may include: (a) diffusion and directed motion of molecules and polymer on surfaces subject to applied external force, (b) separation by size on the surfaces of large molecules such as DNA, (c) probing large molecules by atomic force microscope (AFM), and etc. In all the cases mentioned above, a frictional contact occurs and the ability to control and manipulate friction and motion may result in significant advancement. However, it is very challenging.

In our tutorial, we will discuss theoretical and computational models that can be applicable for bioengineering processes involving frictional contact, review recent studies and techniques to manipulate and control friction at the nanoscale, and present experimental results that demonstrate the feasibility of successful friction control. We will demonstrate that tiny perturbations to the sliding system may result in significant (orders of magnitude) reduction in friction coefficient and discuss the effect of surface structure on the sliding.